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P R E F A C E .

Under direction of the Board of Trustees, the nineteenth annual report of the Missouri Botanical Garden is presented to the public.

The eighteenth report was issued December 7, 1907, but Professor Blankinship's account of Lindheimer and his collections was separately distributed on November 25th, and separates of the other scientific papers contained in the volume were issued on the 27th of November.

These reports are sent to scientific institutions and journals, in exchange for publications and specimens desirable for the library, herbarium or living collections of the Garden. So far as is possible, reprints of the botanical articles they contain are sent to botanists occupied with a study of the subjects to which they pertain.

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WILLIAM TRELEASE.

St. Louis, Mo., Sept. 25, 1908.

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ILLUSTRATED STUDIES IN THE GENUS OPUNTIA.—I

BY DAVID GRIFFITHS.

This paper contains descriptions of species collected and studied by myself in the field during the past five years. The type locality of each has been visited not less than twice, many of the plants have been grown to maturity from cuttings, and seedlings are being cultivated. The type numbers refer to specimens mounted on sheets, but the plants are also in cultivation.

The studies are to be continued as plants reach maturity. It will doubtless be necessary to say more about some of these as they get older and present other diagnostic characters.

***Opuntia Cardenche* sp. nov.**

An open branching tree, 1.5 to 2.5 meters high, with a dark scaly trunk 6 to 10 cm. in diameter; joints variable, laterals commonly easily separable and shorter (1 dm.) than the main or secondary axes, which may vary from 2 to 6 dm. in length, last year's joints commonly close to 2 cm. in diameter, tuberculate, with the large oval areole on the upper shorter slope of the long compressed tubercle, the upper tubercular slope being nearly perpendicular in young joints; areoles broadly ovate, 5 to 7 mm. in longest diameter, usually showing distinct subareolate areas, gray-black below and gray-brown above, the wool area developing for some years until the areole becomes subcircular, often 1 cm. in diameter, or often elongated transversely; spicules in a compact tuft in upper portion of areole, dirty gray or yellowish in situ but distinctly bright reddish brown when separated from plant; spines on last year's joints 1 to 4, mostly 4, and most numerous near middle of joint, bone-like, translucent, or slightly flesh colored, or even reddish tinged at very base, erect, spreading, with lower central one longest (2.5 cm.) and others slightly shorter, all with deep straw-colored medium loose sheaths; intermixed with spines but distinct from spicules are 4 to 6 very small unsheathed, inconspicuous, fugacious, gray-black bristles, 3 to 6 mm. long; flowers light purple, about 4 cm. in diameter; petals obovate to obovate, cuspidate pointed, denticulate, and often slightly crenulate; sepals greenish (second row), short, abruptly cuspidate pointed; filaments purplish green, stout; style white at base and tinged with purple above; stigma yellowish white, about 6-parted; ovary obovate, deeply pitted at apex, 2.5 cm. long, with areoles subcircular, 2 to 3 mm. in diameter on upper short and almost vertical slope of tubercle, bearing a compact tuft of spicules, a few scattering bristles like those of the stem, and a few fugacious, delicate white or yellowish, partially sheathed

spines, with dilated reddish bases; fruit remaining attached for several years, at 12 months of age yellow, nearly smooth, slightly dished, flattened or even convex at apex, with prominent spicules, 3 to 3.5 cm. in diameter.

The species may be looked upon as standing between *O. Kleiniae* and *O. imbricata*. Our cultivated specimens three years old have stems three inches in diameter at base and stand over five feet high.

The description is compiled from one taken in the field when the species was discovered, and another made of the living cultivated progeny. The specific name, cardenche, is universally applied to this species but it is also applied to the much more common species *O. imbricata*.

The type is no. 9221 D. G., collected April 21, 1908, from specimens cultivated from cuttings secured near San Luis Potosi, Mexico, in March, 1905.—Plate 21.

***Opuntia neoarbuscula* sp. nov.**

A low spreading, compactly branched, cylindrical stemmed plant, 8 to 10 dm. high and 10 to 15 dm. in diameter, proliferously and compactly branched, the branches falling off readily; joints tuberculate, 10 to 15 cm. long, and about 8 mm. in diameter (last year); leaves subulate pointed, 8 to 10 mm. long, circular in section and with tips brownish or reddish; roots often but apparently not uniformly bearing tuberous thickenings; areoles large, 3 mm. in diameter, and convex, projecting 1 to 2 mm. high, dull gray; spicules dirty yellow with bases a little darker and brighter in color, 1.5 mm. long, in a compact bunch from upper portion of areole; spines, on late growth of last year, 1 completely sheathed about 2.5 cm. long, with 1 to 3 more delicate, partly sheathed, lower recurved ones, on older wood of last year centrals are 4 to 10, completely sheathed, from a more prominent projecting areole, straw color to brownish red, usually faintly annular; flowers dull red with more or less of purplish tinge with petals obovate, irregularly and minutely dentate, and often irregularly cleft, and sepals ovate, truncate or triangular and abruptly pointed above, filaments greenish below and purplish above and anthers orange; pistil about 2.5 cm. long with style greenish white below and slightly tinged with purple above, and stigma yellowish white, 6 parted, small; ovary obovate-clavate, tuberculate, 2.5 cm. long, with comparatively large brownish gray areoles, and one partially sheathed, delicate, fugacious spine, 1 cm. long, and 2 to 4 scattering, delicate, unsheathed, fugacious bristles.

This differs from *O. arbuscula*, to which it is most closely related, by color of flowers (of minor importance), difference in habit and character of spines.

The description is a compilation of two—one made in the field where the species was first collected, and the other from living, mature, cultivated plants. The name is coined to designate a relationship to *O. arbuscula* Engelm.

The type is a specimen prepared from the cultivated plant and numbered 9219 D. G., April 22, 1908. The plant was originally collected in the foothills of the Santa Rita Mountains, Arizona.—Plate 23, upper figure; compare Plate 22.

***Opuntia castillae* sp. nov.**

An erect, compactly branched plant, 18 to 30 dm. high, with a strong, scaly, black trunk 3 or 4 dm. in diameter; young growth deep dark green, turning slightly glaucous, then scaly brown, and finally black; joints broadly obovate, commonly 21 by 28 cm., thick; areoles elliptical to obovate, about 6 mm. in longest diameter, enlarging to subcircular on old joints or in vicinity of the articulation becoming transversely elongated, or linear, deep purplish brown when young but soon becoming black; leaves dark glossy green, circular in section, subulate, with reddish apex, ending in a white or gray, delicate, recurved apiculus; spicules yellow, seldom visible on the joints; spines white, translucent bonelike when young but soon turning to a mottled, dirty gray, 1 to 5 on last year's joints, more commonly 1 to 2, but central, unless alone, more erect than others, when two or more, one or more tightly recurved, more or less flattened or triangular-twisted, never annular but sometimes crooked-wavy, 15 to 22 mm. long, increasing in both length and numbers for several years; flowers yellow, tinged with red, 8 to 9 cm. in diameter; petals broadly obovate, rounded, retuse-notched at apex and minutely and irregularly toothed on margin, yellow with tinge of red on outside in lower portion of midrib; sepals thick (second row), dull greenish-red, triangular pointed above and wing-like toothed edges; filaments yellow above and greenish below; pistil 2.5 to 3 cm. long; style brilliant red; stigma light green with tinge of red in outer folds as well as in the throat, 8- to 12-parted; ovary broadly obovate or subglobose with subcircular areoles about 2 mm. in diameter and 5 mm. apart, deep dark brown with sometimes a tinge of purple, beset with dark brown spicules and a few dark brown short (6 mm.) delicate, straight or contorted fugacious hairlike spines, deeply pitted at apex; fruit large, yellowish, toothsome.

This is known only from cultivated specimens brought from Mexico. In general habit and appearance it resembles *O. streptacantha* about as closely as any, but it is much less spiny and the spines are not so stiff and rigid. The joints also are somewhat longer and the fruit is entirely different.

The description is drawn from the cultivated plant which

reached maturity in 3 years from single joint cuttings. The name applied to the species is used in Mexico and along our border in a very loose way. It is applied to many species, and has no reference, as one might suppose, to their origin. This is but one of several species called "Nopal de Castilla."

The type is no. 9213 D. G., prepared from a plant which has been cultivated to maturity from cuttings secured in Southern Texas. The plants from which cuttings were secured were developed from cuttings brought from Mexico about twelve years ago. The species has been found in cultivation in several situations in southern Texas.—Plate 24.

***Opuntia fuliginosa* sp. nov.**

A tall, open branching tree, 4 or more meters high, and 4 or more dm. in diameter at base, with a black scaly trunk, very woody; joints sub-circular to obovate, bright yellowish, glossy green, invariably turning to a dark, sooty hue with a fungous (?) growth, very variable in size, commonly about 1.5 by 2 dm., thin, scarcely tuberculate, yet not perfectly smooth; leaves subulate pointed, 8 to 12 mm. long; areoles elliptical to obovate, 4 or 5 mm. in longest diameter, light gray becoming tawny and finally black, 3 to 4 cm. apart; spicules yellow, very variable, often brownish, unequal in length, but commonly 8 to 10 mm.; spines 2 to 3 cm. long, translucent, bone-like, light brown, becoming whitened distally, leaving bases brownish translucent but in second or third year becoming a dirty, mottled gray throughout, suberect, spreading, with the lower recurved and the central longest, flattened, and often twisted, 2 to 8 in number but more commonly 2 to 4, increasing in both length and numbers for 2 or 3 years; flowers yellow streaked with red and always red when closed, small, 4 cm. across when open and about 2.5 cm. long; filaments light chocolate; stigma yellowish green, 6- to 9-parted; ovary subglobose to obovate, deeply pitted, thickly beset with subcircular areoles bearing a few spicules and a few delicate fugacious spines; fruit red, obovate to pyriform, with circular areoles, well filled with a large tuft of prominent yellow spicules surrounded by the blackened wool, pulp very deep red and rind thin.

The species is easily recognized by its blackened appearance in its native habitat, but this coloration is entirely lost when cultivated in this country. The spines and flowers and bright glossy appearance of the young growth in its native home, and of the entire plant under cultivation (three years old) in this country, are very characteristic. The species is very

variable in spine characters, some plants being nearly spineless, but usually the spicules are never absent.

The original description was drawn at Estansuela in western Jalisco, Mexico, from plants in bloom. This was subsequently compared with plants at Guadalajara, and still further amended by a second visit to the latter place during maturity of the fruit. A name indicating a sooty appearance is preferred for this species on account of its prevalence, although this condition is evidently not normal.

The type is no. 7715 D. G., collected near Guadalajara, Mexico, April, 1905.—Plate 25.

***Opuntia Cochineria* sp. nov.**

A low, rather compactly branched, turgid species, 8 to 12 dm. high, with broadly obovate, thick, turgid joints commonly 20 by 28 cm., but sometimes 25 by 40 cm., dull green when young, glaucous waxy when mature, and turning to a scurfy brown with age; areoles 1.5 to 4 cm. apart, circular to obovate, 3 to 6 mm. by 3 to 5 mm. in young joints, but increasing to nearly one cm. in diameter in age, reddish brown when young, but turning to a dirty gray, slightly convex; spicules very rare on the joints, an occasional areole with a bunch of long yellow ones, 3 mm. long, with remainder of joint devoid of them; spines white becoming mottled gray with age, flattened and often twisted, erect-divergent, but often with a strong tendency to be recurved, 3 to 6 on this and last years' joints, but often 15 to 20 on older wood, about 2 cm. long on younger joints, and 3.5 to 4 cm. long on older wood; flowers yellow; fruit red, subglobose, 5 to 6 cm. in diameter, with thick, heavy rind, circular areoles 3 mm. in diameter and 8 to 12 mm. apart, bearing short, yellow spicules about 2 mm. long and a few longer, delicate fugacious spines; seeds large, strongly angular, with heavy, irregular marginal thickening.

This species has characters resembling those of very widely differing species. Outwardly the fruit resembles that of nopal arton, a large robust species closely related to *Opuntia streptacantha*. In form the joints resemble that species also, but in color and texture they resemble those of nopal tapon, *O. robusta*. The spines and spicules resemble those of tapon quite closely, except in numbers and size. On the herbarium sheet the joint looks like a short, stout, white spined form of tapon.

The description was drawn beside the plant in the field. The specific name is considered by the Mexicans to be de-

rived from the Spanish word for hog. It may be derived from cochineria, the equivalent of the English word meanness, referring to the spines.

The type is no. 8490 D. G., collected at Los Campos, Zacatecas, Mexico, September 5, 1906.—Plate 26.

***Opuntia Chaveña* sp. nov.**

An open branching, erect tree, 18 to 30 dm. high, sometimes quite strict but more often with a span of 12 to 18 dm., with distinct black, scaly trunk; joints rather bright yellowish green, and maintaining the same color for four years or more, broadly obovate, about 22 by 30 cm. being common size; areoles circular below to obovate above, about 6 mm. in longest diameter, but increasing in size with age, 2 to 3 cm. apart; wool tawny, plainly cellular-jointed, black on surface; spicules lemon yellow, very variable in length, at times scarcely reaching surface of joint and at other times 9 to 10 mm. long; spines white with translucent tips, soon becoming mottled and finally dirty gray or black, slightly angular, flattened, but not twisted, 5 to 7 or 8 on last year's joints, and increasing to 15 or more on older joints, but apparently not increasing after 4 or 5 years, longest on last year's joints, 12 to 14 mm. and graduating down to 2 or 3 mm., often 3 cm. long on older joints, stiff, rigid, erect, spreading and very difficult to handle; flowers yellow, filaments greenish, style red, stigma light bright green (only one belated bloom seen); fruit red with thick rind and deeper red pulp, its areoles subcircular to obovate, 8 to 12 mm. apart, with a tuft of formidable yellow spicules surrounded by gray ends of wool, also bearing a few delicate fugacious yellow spines about 12 mm. long; seeds angular, scarcely notched at hilum, with narrow marginal thickening.*

The species is most closely related to the *O. megacanthalasiacantha* group, but these species differ in fruit characters and color of joints especially, and constitute a distinct group in themselves. They are well recognized and divided into three or four varieties even by the Mexican peon.

In this species I include three varieties recognized by the Mexicans, namely, "caidillo," "chaveño," and "cascaron." The first is distinguished mainly by its habit of dropping its fruit when ripe, it also has on an average rather smaller joints. Cascaron has joints somewhat larger and more nearly circular than chaveño. The first and last names are less frequently used than chaveño, it being commonly the only name applied to any form of the species.

* See Bull. 16, pl. 6, f. 8, B. P. I., U. S. Dept. Agric.

The description is a compilation of three sets of notes taken in the same locality at different times. The specific name is universally used in the region to designate this plant. I am doubtful about its meaning. The significance of the names applied to the varieties is more evident.

The type is no. 8136 D. G., collected near Aguas Calientes, Mexico, September, 1905.—Plate 23, lower figure.

Opuntia Guillanchi sp. nov.

Plant erect, bushy, open branching, 1.5 to 2 meters high, often forming small thickets but also growing in isolated individuals, having a distinct trunk 15 to 25 cm. in diameter; joints obovate, commonly 16 by 24 cm., or less, often about 14 by 20 cm., medium dark green, minutely pubescent, turning brown papery-scaly and finally black; areoles subcircular to obovate, small, 2 to 3 mm. in diameter but increasing on old trunks to about 5 mm., slightly elevated, 12 to 15 mm. apart; wool light tawny black on end; spicules very light yellow, usually less than 2 mm. long for a year or more, and completely surrounded by the blackened wool, making them subcentrally located, but later they develop in upper portion of areoles to 2 mm. or more in length; spines white, becoming mottled very early and finally dirty gray, erect spreading, 2 to 3 on sides of last year's joints to 4 or 5 on the edges where the lower ones are recurved, slightly flattened, often twisted, never annular, brittle, brash and small in diameter, varying from 5 to 13 mm. in length on sides of last year's joints to 2 cm. on edges, increasing in both length and numbers on old joints where they may be 3.5 cm. long with one or more in each areole broadly curved; flowers not seen; fruit pubescent, aromatic, variable in color, mostly yellow, but often orange red at base and yellowish distally, rind greenish yellow, outside of pulp orange red with interior much lighter, and easily separable from seed, its areoles small, subcircular, about 6 mm. apart and beset with formidable yellow spicules, subglobose, about 4 cm. in diameter, with shallow, broad umbilicus; seeds irregular, angular, not notched at hilum and with marginal thickening very narrow, about 4 mm. in diameter.

The species stands in some respects between the durasnillo (*O. leucotricha*) and the *O. megacantha-lasiacantha* groups of Mexican prickly pears. It differs from both in stature and habit, from the former in its spines especially, and from the latter in color of plant body but more especially in its fruits.

The description is compiled from field notes taken upon two visits to the type locality, supplemented by the dried

specimens. The specific name is the common Mexican name applied to this plant.

The type specimen is no. 8149 D. G., collected near Zacatecas, Mexico, September, 1905.

***Opuntia Guerrana* sp. nov.**

A suberect or ascending, open branching plant, 9 to 12 dm. high and about the same in diameter; joints oblong obovate to subcircular, thick, heavy, glaucous, blue-green, 15-20 cm. by 20-25 cm.; areoles black, subcircular to obovate, about 5 mm. in longest diameter; wool tawny; spicules yellow, abundant, unequal, on sides and lower portion of edge in a compact crescentic tuft, 1 to 2 mm. long but around the apex of joint there may be an abundance of them lengthened to 1 or 2 cm.; spines white or light straw color and translucent at the base but turning a mottled dirty black with age, 1 to 6, mostly 2 to 4, flattened, often twisted, erect, divergent or some of lower in areole somewhat recurved; flower yellow, filaments greenish white, stigma green, fruit subglobose, greenish white, 4 to 5 cm. in diameter, with seed variable and much aborted, but mostly large, 4-5 by 5-6 mm., deeply notched, marginal thickening prominent, 1 mm. wide.

The species is related to *O. robusta*, but is smaller throughout, with very different fruit. It is known as Nopal tapon or Nopal tapon blanco in some sections. This shows its relations to the common "tapon" of the Highland region.

The description is compiled from a partial description made in the field, supplemented by further notes from the dried specimens. It is with pleasure that I dedicate this species to my friend, Señor Enrique L. Guerra, who first called my attention to the existence of such a species and to whom I am indebted for much information about Mexican species of *Opuntia*.

The type is no. 8475 D. G., collected near Dublan Hidalgo, Mexico, September, 1906.

***Opuntia discata* sp. nov.**

Plant ascending-erect, rather compactly branched, 9 to 15 dm. high and about the same in diameter; joints broadly obovate to subcircular, commonly about 25 by 27 cm., dark green when young, but gray waxy green when mature; leaves about 1 cm. long, subulate pointed, slightly flattened; areoles large, prominent, circular to oval, tawny to brown when young and black in age, 6 to 10 mm. in diameter, much larger on edges of

joint than on sides, often distinctly subareolate and developing new wool and spicules from season to season; spicules yellow, unequal, scattered, increasing with age, 2 to 3 mm. long but often 1 cm. or more in length; spines white or dirty gray, with often a reddish tinge below or often pinkish throughout, one on lower portion of joint to 7 above, commonly 3 to 6, the longest 2.5 cm. long, erect-divergent or often the lower recurved especially on edges of joints, angular flattened, very stout and formidable but neither annular nor twisted; flowers lemon yellow with bases of petals a darker orange; filaments greenish-white, style white, and stigma dark green, 8-parted; fruit obovate to pyriform, deep, dark red throughout, 6 to 7 cm. in length.

The species differs from *O. cycloides* in character of spines. In this species they are much shorter and more erect.

Description drawn in the field. The specific name refers to the shape of the joints.

The type is no. 7790 D. G., collected in the foothills of the Santa Rita Mountains, Arizona, April, 1905.—Plate 27, upper figure.

***Opuntia ferruginispina* sp. nov.**

Plant erect-ascending with open-branching habit, 7 to 12 dm. in height and same or greater in breadth; joints broadly obovate, about 20 by 23 cm. in last year's growth, deep blue-glaucous green; areoles about 3 to 3.5 cm. apart, obovate, 6 to 10 mm. in longest diameter, gray to black, enlarging with age; spicules bright reddish-brown, numerous, unequal, formidable, often 12 mm. long but usually much shorter; spines numerous and formidable, brown at base but becoming gradually yellowish distally, 1 to 4 on last year's joints, becoming more numerous with age, flattened, twisted, faintly annular, diverging in all directions or often the lower recurved, the longest sometimes 6.5 cm. long but commonly about 4 to 5 cm. long, both spines and spicules increasing in numbers with age and enlarging the areole; flowers orange-red, about 7.5 cm. in diameter when open; petals broadly obovate, rounded above, with edge irregularly and minutely toothed and often slightly crenulate and with midrib terminating in a minutely cuspidate point often having a tinge of purple in its lower portion; sepals (second row), triangular-winged, greenish; filaments yellow with faint tinge of purple; pistil 3 to 3.5 cm. long; style white with faint tinge of purple; stigma light green, about 8-parted; ovary obovate to pyriform-stipitate, 5 to 6 cm. long, with tawny areoles comparatively distant and bearing a small tuft of reddish brown spicules of irregular length; fruit purple throughout.

This species differs from *O. Lindheimeri*, with which it has been confused, in color of plant body, color and character of

the spines and spicules, as well as in the color of the flower (of minor importance). It appears to be most closely related to Berger's *O. Winteriana*.

The description was drawn from the living plant in bloom in the field. The specific name refers to the color of the base of the spines.

The type is no. 9207 D. G., collected near San Antonio, Texas, April 21, 1908.

***Opuntia magenta* sp. nov.**

Plants ascending to erect, divaricately and loosely branched, 6 to 10 dm. high, often forming thickets on steep banks and hillsides; joints obovate, 9.5 by 13 cm. to 11.5 by 21 cm., more commonly the former, bright green when young but turning to slightly glaucous green; leaves about 1 cm. long, circular in section, subulate pointed; areoles 2 to 3 cm. apart, ovate, obovate or subcircular, increasing in size with age; spicules yellow, 2 to 3 mm. long, in a compact bunch in upper portion of areole, but increasing with age, and becoming unequal and scattered throughout the entire black areolar area; spines reddish brown at base and yellow distally, turning chalky or dirty black, often chalky throughout without any evidence of red at base, 1 to 5 or 6, usually 3 or 4, erect, divergent or lower recurved, the longest 2 to 2.5 cm. long, slightly angular, flattened and faintly annular when young but all traces of this are lost with age; flowers a light magenta; petals obovate, broadly obovate and cuspidate at a pex; style and filaments pink, and stigma large, yellowish green, 8-to 9-parted; ovary obovate to pyriform, about 3 by 5 cm.; fruit reddish purple.

The species is easily distinguishable in bloom by the color of its flowers and at other times by the prominent peculiar black areoles which differ very much from the *O. Lindheimeri* group with which it has been confused. It differs in joints as well as in habitat from *O. angustata* as figured by Engelmann.

The description is compiled from one made in the field, amended by subsequent notes at another season. The name refers to the color of the flower.

The type is no. 7876 D. G., collected near Redlands, California, May, 1905.

***Opuntia macrocalyx* sp. nov.**

A profusely, divaricately branched, ascending or erect, spreading plant, 9 to 10 dm. high and about the same in diameter; joints long-obovate,

variable but commonly 9 by 22 cm. for last year's growth, gray green, pubescent, velvety to the touch; areoles subcircular, usually 2 to 3 mm. in diameter, very close to 1 cm. apart, slightly sunken; wool tawny, prominent, as long as spicules and occupying lower half of areole; spicules reddish brown, about 1 mm. long, occupying upper half of areole, easily separable and causing fully as much annoyance in handling as those of *O. microdasys*, in age often appearing dirty yellow in situ but distinctly reddish brown when removed; strictly spineless; flowers yellow, green outwardly, the leaves on ovary very long subulate and changing gradually into the sepals which are very long subulate, delicately pointed, loosely arranged or often half recurved at apex, giving to the bud a rather ragged appearance; fruit red but both pulp and rind greenish, long obovate to cylindrical, about 2 by 7 cm., with but few rather small seeds, about 3 mm. in diameter.

This species has hitherto been confused with *O. microdasys*, from which it differs in shape and color of joints, general aspect of plant and especially in the floral and fruit characters. This species should not be confused with the brown spiculed form of *O. microdasys*. Such a form exists commonly in the States of San Luis Potosi and Zacatecas, Mexico, but it differs in no other way from the more common yellow spiculed form ranging from the Rio Grande region southward.

The description is compiled from copious notes taken at San Antonio, Texas, and Riverside, California, at various times during the past five years. The name refers to the long loosely arranged sepals which grade on the one hand almost imperceptibly into the leaves on the upper part of the ovary and on the other nearly as gradually into the inner perianth segments.

The type is no. 8283 D. G., secured from the Albert S. White Park, Riverside, California, May, 1906. Its origin is not known but it is found commonly cultivated in collections of cacti in the Southwest.—Plate 28. upper figure: compare with the lower figure.

***Opuntia lucens* sp. nov.**

A low prostrate species, usually about 3 or 4 dm. high; joints subcircular to obovate, variable in size, 1 by 1.5 dm. to often 2 dm. in longest diameter, bright, glossy, yellowish green; areoles large, prominent, black, variable, obovate, 4 to 10 mm. in longest diameter, 2 to 4 cm. apart; wool tawny, turning black at maturity; spicules yellow, prominent, unequal,

commonly 3 mm. long on sides but mostly about 1 cm. long on upper edges, in crescentic bunch in upper portion of areole or scattered throughout its area; spines very variable in length, the longest centrals 3 to 4 cm. graduating down to $\frac{1}{2}$ cm. in length, 2 to 5 in number with 2 or 3 additional delicate bristles besides, white with translucent tips and turning abruptly bright reddish brownish at base, flattened, angular, twisted, often striate but never annular; flowers yellow; fruit purple, obovate, with reddish purple rind and darker pulp; seed flattened, angular, deeply notched and having a prominent marginal thickening, 4 or 5 mm. in diameter.

The species is related to the *O. Engelmanni* group but has different habitat as well as other minor differences. The old joints in this locality become scaly brown after the first year, but this is probably due to parasitism. Plants which I have grown to four years of age are bright yellowish green, exactly like the younger growth in the natural habitat of the plant. The only difference in the cultivated specimens is a greater turgidity. The species is commonly called "cuija" but it is a very different plant from the one to which this word has been applied as a subspecific name.

The description is a compilation of two sets of field descriptions made at different seasons in the same locality, supplemented by additional notes from herbarium specimens. The name refers to the character of the surface of the joints.

The type is no. 8034 D. G., collected near San Luis Potosi, Mexico, August, 1905.

***Opuntia linguiformis* sp. nov.**

An erect, ascending, or half prostrate species, commonly too weak to stand erect, young growth light blue-glaucous green, older growth yellow and becoming scaly, scurfy brown with age; joints very variable, linear to narrowly ovate-oblong, often 1 by 8 dm., or again broadly ovate or even subcircular; leaves about 6 mm. long, circular in section, cuspidate pointed; areoles subcircular, 4 to 5 mm. in diameter, tawny to gray-black, upper half filled with dirty yellowish-brown, unequal spicules, about 6 mm. long; spines yellow, commonly slightly tinged with red at base, angular, flattened, annular, slightly twisted, 2 to 6 on last year's joints, mostly 3 or 4, one 2.5 to 4.5 cm. long, erect or sloping downward slightly, the others divergent around it and much shorter; flowers deep yellow or old gold, 7 to 8 cm. in diameter, petals obovate, obcordate, cuspidate at apex, and minutely toothed on edge, filaments white, slightly greenish below, style white, slightly tinged with green at base; stigma yellow, about 9-parted, ovary obovate to pyriform, 6 to 7 cm. long, with small,

subcircular areoles bearing brown spicules with yellow tips and small delicate fugacious, tightly recurved spines; fruit reddish purple; seeds small, about 3 mm. in diameter.

This species is cultivated commonly throughout the Southwest, but has been considered a variety of *O. Engelmanni* by botanists who have considered it at all. Its origin has until recently been unknown. It is evidently a native of southern Texas and a rather rare species. I have seen it in three localities near San Antonio and one farther south.

Description drawn from mature cultivated plants. The Spanish name lengua de vaca is descriptive and appropriate for this species. The "cow's tongue" cactus is the commonly used English equivalent.

The type is no. 8377 D. G., collected near San Antonio, Texas, Aug., 1906.—Plate 27, lower figure.

***Opuntia fuscicaulis* sp. nov.**

An erect, strict, open branching tree from 4 to 5 meters high, with a black, scaly trunk, 3 or 4 dm. in diameter; joints very long, fusiform, commonly about 4 dm. long by about 12 cm. wide, glaucous blue-green; areoles subcircular, small, 2.5 mm. in diameter, and 2.5 to 3.5 cm. apart, slightly sunken; spicules, when present at all, scarcely reaching the surface; wool tawny; spines entirely absent or there may be one delicate, white, fugacious one in an occasional areole; flowers said to be red; fruit greenish white.

This species might be confused with *O. elongata*, but it is spineless and the joints are fusiform and differ in color.

The description is compiled from notes taken at Aguas Calientes, supplemented by additional descriptions made of the cultivated plant which is now three years old, but has not yet bloomed. The specific name refers to the shape of the joints.

The type is no. 9312 D. G., prepared from a specimen cultivated from cuttings secured at Aguas Calientes, Mexico, in March, 1905. It is known only from cultivation.—Plate 23, upper figure, at left.

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EXPLANATION OF PLATES.

Plate 21.—Above, *Opuntia Cardenche* at right (1), *O. leptocaulis* at left (5): one of the others may be *O. Kleiniae*, and the remaining two are undescribed species for which more data are needed. Below, *O. Cardenche*, cultivated specimens at beginning of the fourth year's growth from small cuttings.

Plate 22.—*Opuntia arbuscula*; introduced for comparison with Plate 23. Above, the species as it grows naturally upon desert mesas near Tucson, Ariz., in favorable situations. Below, a tree form as it grows in favorable situations in deep cañons in foothills of the mountains at an altitude of about 4,000 feet.

Plate 23.—Above, *Opuntia neoarbuscula* in the center, *O. fusiculis* at the left. The former is in the beginning of the third years' growth from small cuttings; the habit in nature and under cultivation is the same. Below, at the right, *O. Chaveña*: a joint from a native specimen at Aguas Calientes, Mexico.

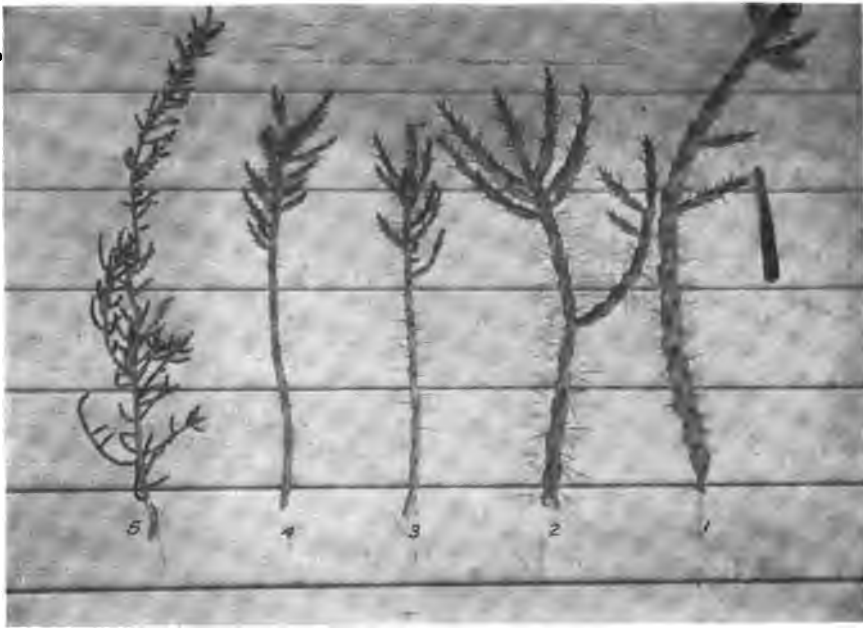
Plate 24.—*Opuntia castillae*. Above, a single plant, early in the fourth year's growth. Below, terminal joints.

Plate 25.—*Opuntia fuliginosa*. Above, a potted plant about three years old. Below (marked by the basket), a native plant. The potted plant, grown in a greenhouse at Washington, is no more like the parent plant, in color, spine, or shape of joint, than *O. fulgida* is like *O. arborescens*. In open ground in California, the growth is normal.

Plate 26.—*Opuntia Cochineria*. Above, a typical native plant. Below, a single joint and fruit.

Plate 27.—Above, *Opuntia discata*: joints two months and one year old. Below, *O. linguiformis*: a mature cultivated plant.

Plate 28.—Above, *Opuntia macrocalyx*: joints in bud. Below, *O. microdasys*: a cultivated plant, for comparison.



OPUNTIA CARDENCHE AND O. LEPTOCAULIS,



OPUNTIA ARBUSCULA.



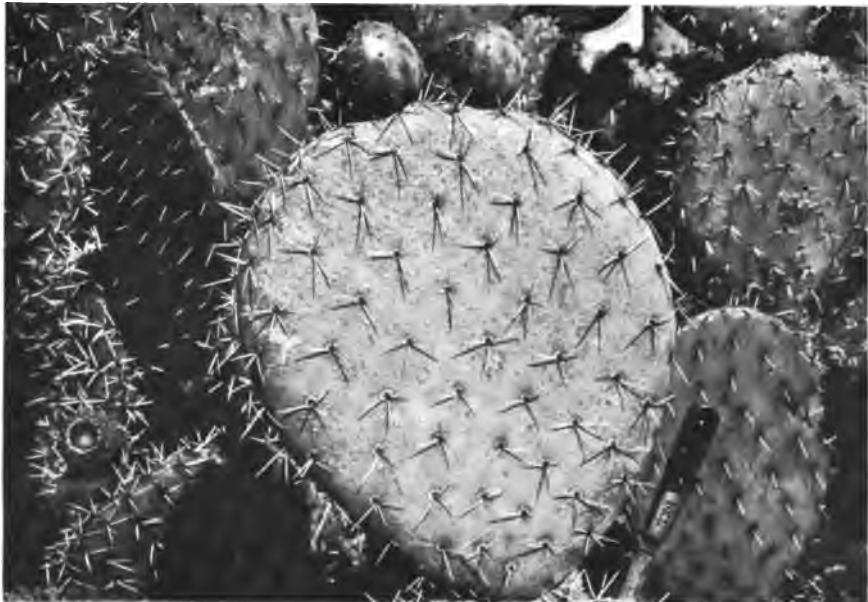
OPUNTIA FUSICAULIS, O. NEOARBUSCULA, O. CHAVEÑA.



OPUNTIA CASTILLAE.



OPUNTIA FULGINOSA.



OPUNTIA COCHINERA



OPUNTIA DISCATA AND O. LINGUIFORMIS.



OPUNTIA MACROCALYX AND O. MICRODASYIS.

